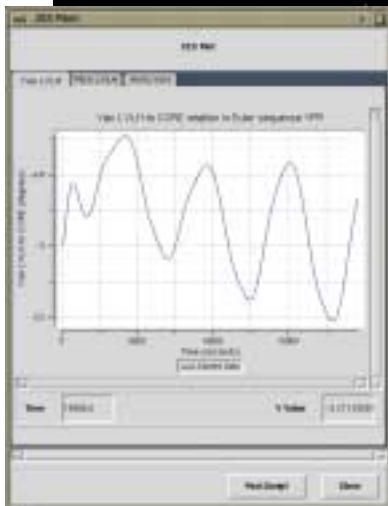
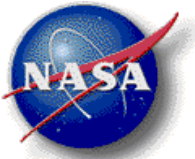


International Space Station Synergistic Engineering Environment (ISS SEE)





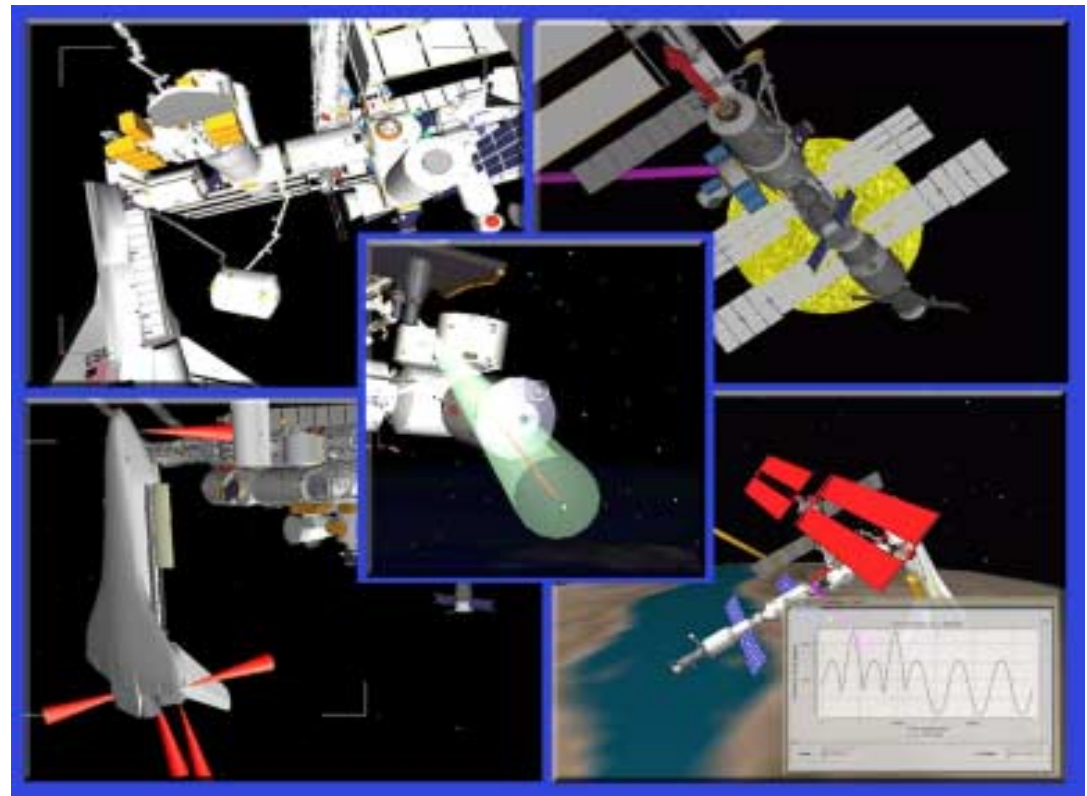
International Space Station (ISS) Synergistic Engineering Environment (SEE)

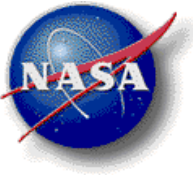
Goal: Create a high level immersive simulator that will model the ISS vehicle, system and payload performance in any user-selected configuration and environment during the lifetime of the station.

Applications: ISS configuration and system trade studies, payload and vehicle accommodation assessments, training, rapid operations assessments, and real-time mission visualization.

Benefits: The interfacing of engineering simulations along with the fusion of on-orbit telemetry will result in reduced risk, increased safety and enhanced life cycle efficiency. The SEE will also provide a collaborative environment for other NASA centers to support the ISS program at JSC.

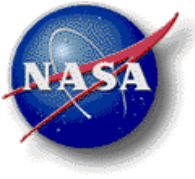
Status: A dedicated facility for using the SEE has been operating at JSC in building 4S for nearly a year. The beta version of the application has already been used in support of Plasma Contactor Unit (PCU) contingency studies and Soyuz thermal assessments.





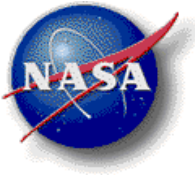
Application of ISS Synergistic Engineering Environment (ISS SEE)

- **The ISS SEE will be primarily used to facilitate the understanding of a problem trade space so resources can be focused on optimizing solutions rather than working the wrong problem.**
- **The environment will facilitate mission operations and reduce risk by providing an immersive interface directly tied to on-orbit telemetry while also allowing collaborative real-time analysis across select systems.**
- **Users can quickly and efficiently evaluate operational procedures, contingencies and assess configuration enhancements during the assembly and operational phases of the ISS.**
- **Interest in continued SEE development is supported by several NASA programs**
 - **Revolutionary Aerospace Systems Concepts (RASC) – Mission Simulation**
 - **Space Launch Initiative (MSFC) – ISS Proximity Operations**
 - **ISS Research Program Office (GSFC) – External Experiment Viewing**
 - **ISS – Viper Team**



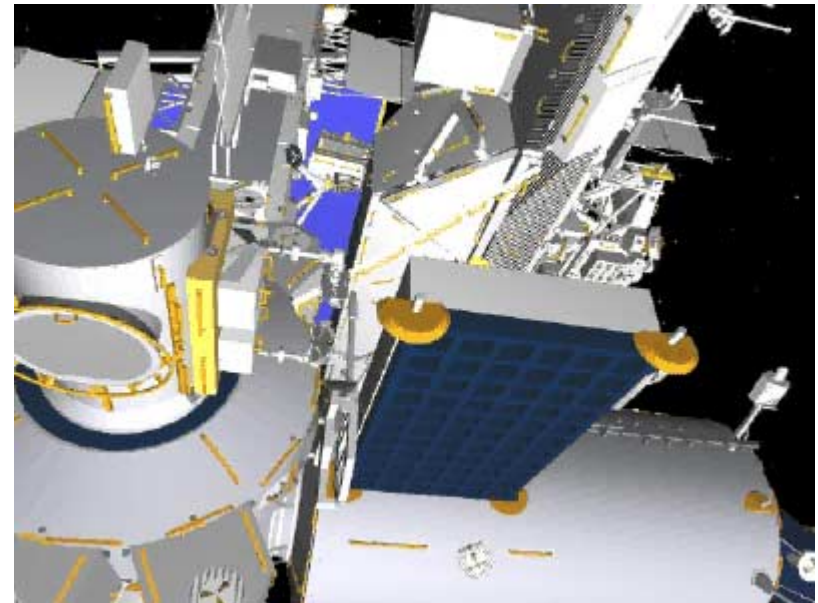
SEE Capabilities

- **Current (12/01)**
 - Import of Baseline ISS Models
 - Integration of ISS Baseline Dynamics Analysis (SSMRBS)
 - Field of View (FOV) Analysis (Payload, Thruster, Camera, Communications)
 - Vehicle Docking
 - Shuttle, Progress, & Soyuz
 - Import user defined vehicle
 - Robotics (SSRMS & SRMS)
- **Near Term Enhancements**
 - Cross platform development (IRIX, Linux, Windows)
 - Interior models
 - Real-time telemetry

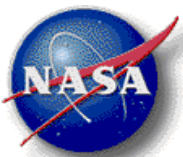


Import Baseline ISS Models

- **ISS Exterior Models from JSC SEMDA Lab**
 - SEE updated with new geometry model releases
 - Obtain corresponding SSMRBS input data files from Dynamics & Controls Working Group
- **Ability to delta from baseline configuration models and perform quick initial assessments**
- **Obtain new SSMRBS software releases from JSC**



Pan starting at Airlock for
Revision M, Configuration 11A

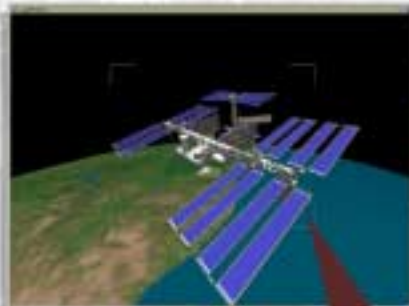


INTERNATIONAL SPACE STATION SYNERGISTIC ENGINEERING ENVIRONMENT DYNAMICS SIMULATION

1

Load a Configuration

Select a space station configuration from a library of models covering the complete assembly sequence, or reload a previously saved session.

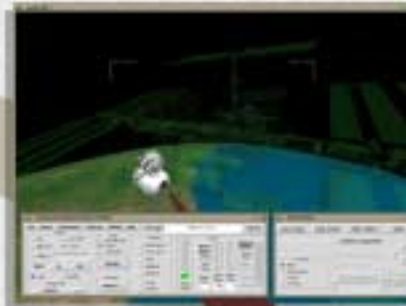


The ISS SEE Dynamics module allows the engineer to modify the station model, run a new analysis, and immediately visualize the results.

Add and Modify Parts

2

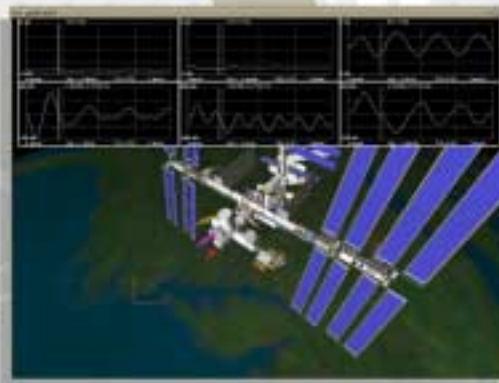
Change the station model by adding, modifying or deleting parts. Choose from the **standard part** library or **import models** from Inventor and IDEAS.



4

View the Results

Examine the new data plots and animation. Change vantage points by flying around or tethering the view to any part in the model. Run the simulation forward or backward in time and pause at any frame in the data set.

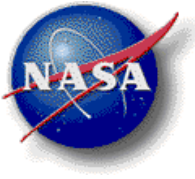


Generate Data

3

View the new mass and area properties of the modified station. Create new input data files for any of several rigid body dynamics simulation tools, including the Space Station Multi Rigid Body Dynamics Simulator.

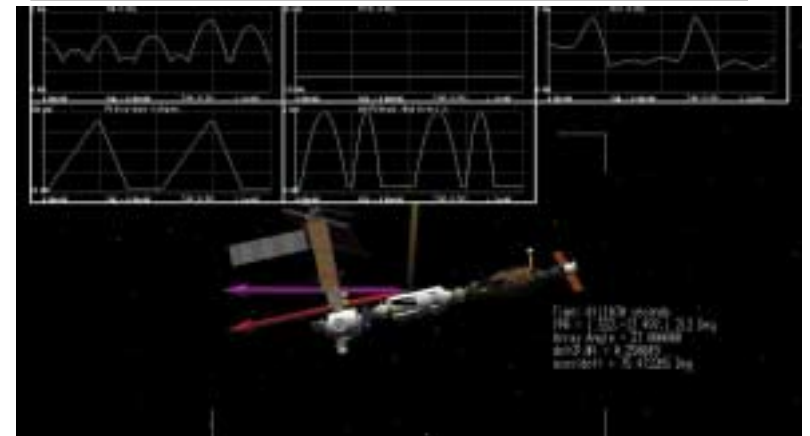
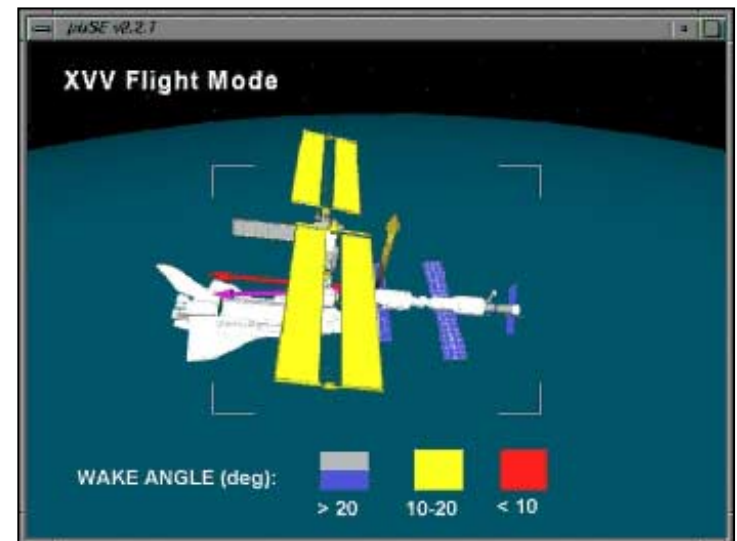




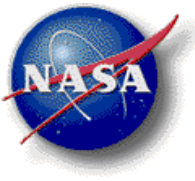
Plasma Contactor Unit (PCU) Failure Contingency Study

- **ISE ISS SEE** used to determine PCU failure contingency plans in direct support of Flight 4A (launched Nov 30, 2000)
- **ISE-provided capabilities:**
 - ISS SEE Test Application Beta 0.2
 - ISS Synergy Laboratory at JSC
- **Results:**
 - New flight rules developed collaboratively, analyzed and presented using ISS SEE Test Application. Rules ported for use in mission operations in the event of PCU failure.

“I learned more in this last half hour than I did in 3 months of meetings” – SEE User

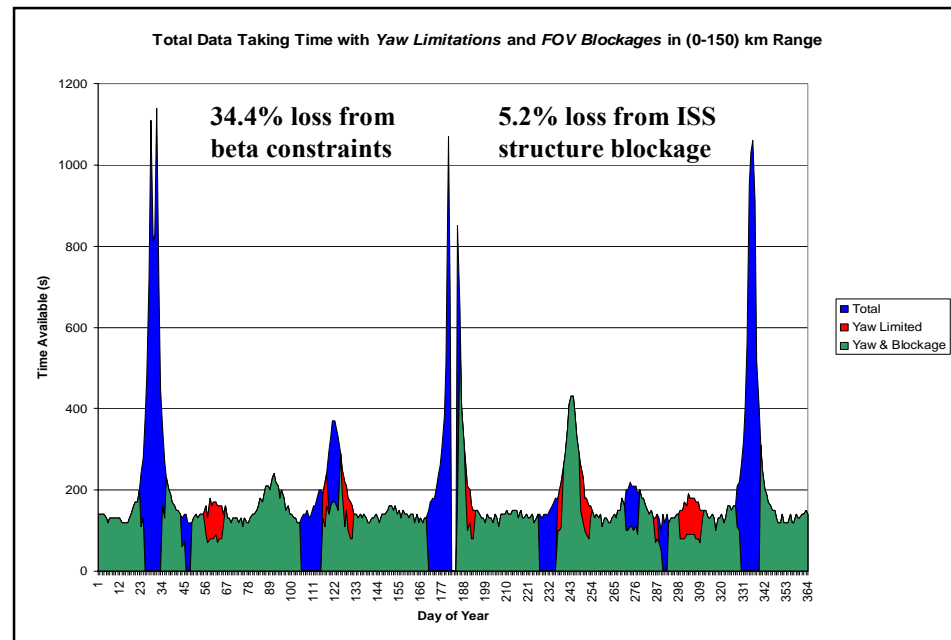


Changes in solar array and flight attitude orientations due to new flight rules

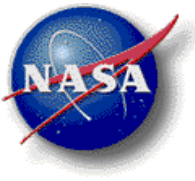


SAGE III Viewing Analysis

- Customization of the FOV viewing capability for analysis of SAGE III operations
- Calculate year-round data-taking opportunities considering varying β -angles and blockages due to fixed and articular parts of ISS



- Animation shows two vantage points of a sample viewing opportunity: One from the starboard side of the ISS and from the view of the instrument itself
- In this particular instance, the high β -angle results in blockage from the ESA module preventing full data acquisition



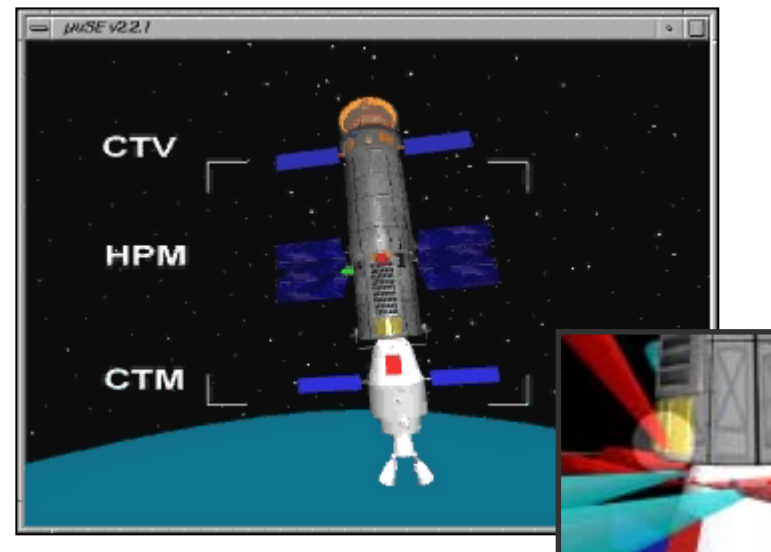
Prox Ops Simulation & Visualization

- Generic docking simulator that can accommodate baseline (Shuttle, Progress or Soyuz) or non-standard (alternate access) docking vehicles
- Playback of pre-processed simulations or real-time simulation data while displaying RCS plumes in a dynamic ISS environment

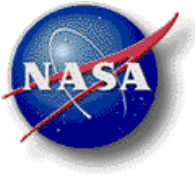
Playback of Shuttle Docking
Simulator Data



Real time simulation of
Alternate Access to ISS



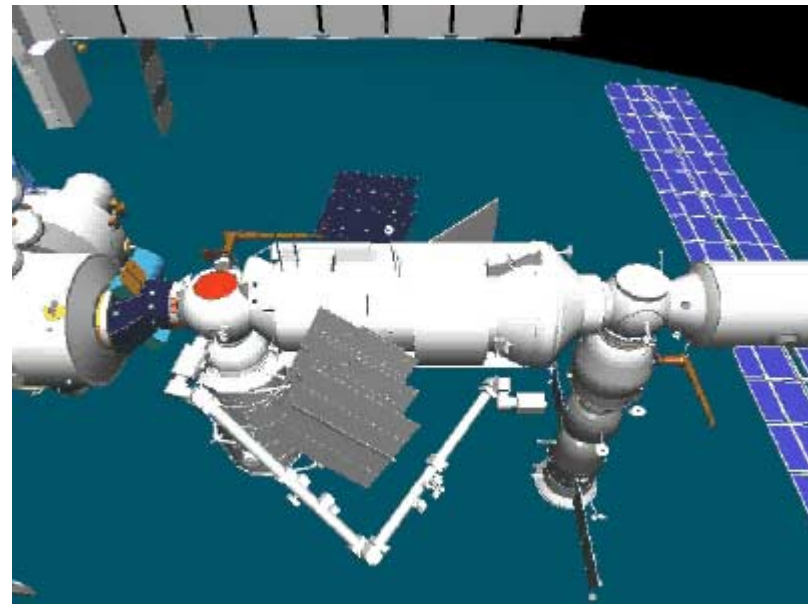
Plume impingement
problem discovered on
original configuration

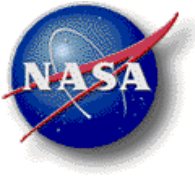


Integrated Robotics Capabilities

- **“First look” robotics capability for the analysis of the SSRMS and SRMS**
- **Capabilities include:**
 - Forward and Inverse Kinematics
 - Grapple and Release
 - Simplified MAGIK file read and export
- **Incorporation of the MBS, JEM arm and Strella are planned**

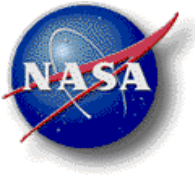
SSRMS repositioning the
DC1/Progress stack for
reconfigured Russian segment





Near Term Activities & Enhancements

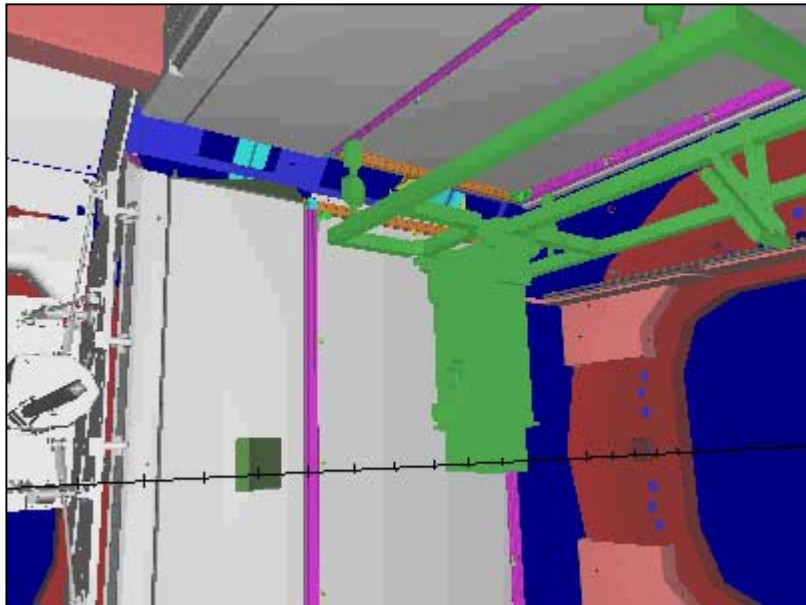
- **Cross Platform Development**
- **Interior Simulation**
- **Real-time ISS Telemetry**



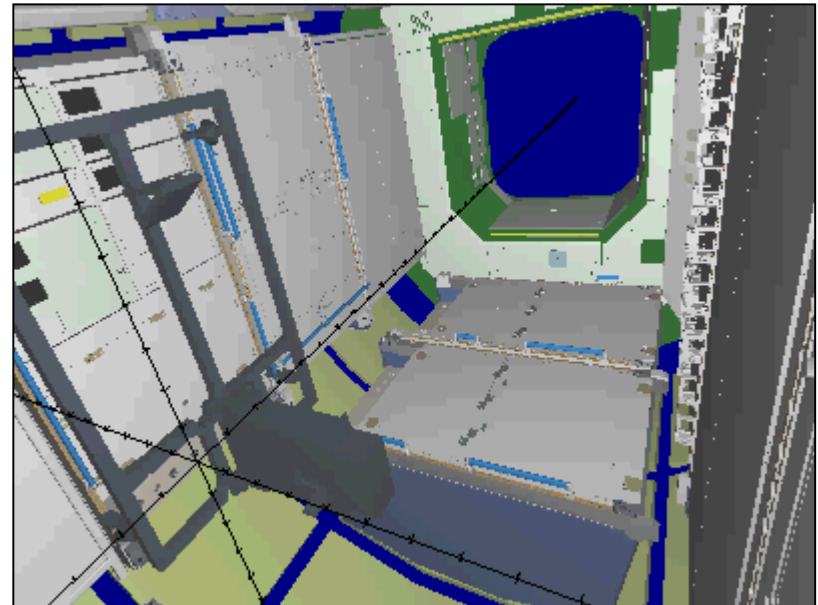
Interior Configuration and Layout Analysis

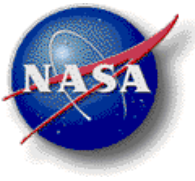
- **Prototype environment for the analysis of the interior configuration of the Lab and Node for the placement of the CEVIS equipment**
- **Environment allows 6 DOF movement, visualization and relocation of CEVIS and racks, and visualization of bounding volumes and escape corridors**
- **Developed using Gizmo3D, which will be utilized for the next build of the SEE software, providing cross platform support for IRIX, Linux, and Windows**

Locating the CEVIS in Node 1



Locating the CEVIS in the Lab





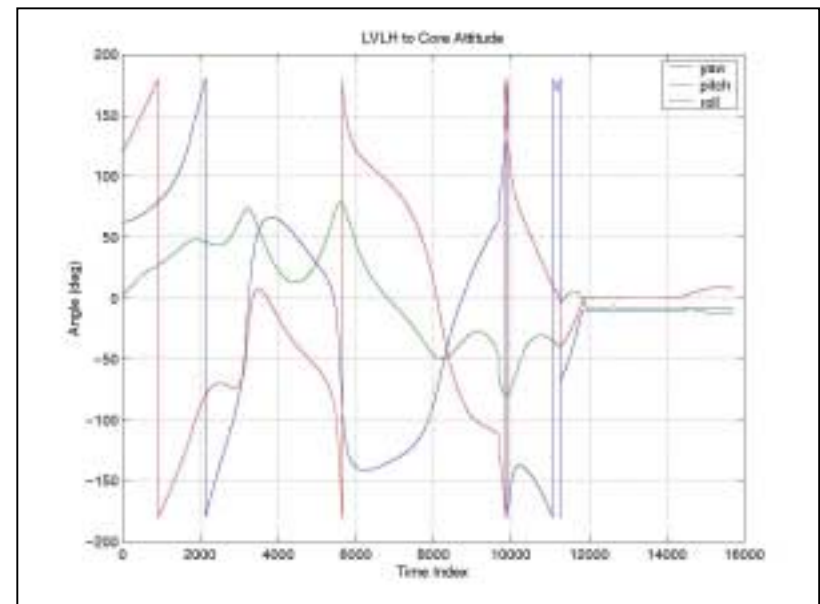
Real-time Telemetry

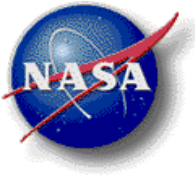
- Secure network connection is being established with JSC to receive real time telemetry feed
- Expected date of capability is Jan or Feb 2002
- Initial data planned is position, attitude, and joint angles

November 28th telemetry data of ISS in
free drift after Progress docking



LVLH to Core YPR
Data Plots from Telemetry





Status of Current (12/01) SEE FY02 Funding/Tasks

Partner	Contribution (\$K)	Task Focus
Revolutionary Aerospace Systems Concepts (RASC)	360	<ul style="list-style-type: none">- Multi-platform port- Comet Asteroid Protection System (CAPS) Mission Simulation- OASIS/HOPE Mission Simulation
Space Launch Initiative - Second Gen	60	<ul style="list-style-type: none">- Import 2nd Gen Vehicle Models for future ISS Prox Ops
ISS	<i>TBD</i>	<ul style="list-style-type: none">- <i>TBD</i>

Potential Partners		Potential Focus
Space Launch Initiative - Alternate Access		<ul style="list-style-type: none">- Proximity Operations Analysis
ISS Research Program Office (GSFC) Code S/Y		<ul style="list-style-type: none">- Payload Analysis

SEE

